REMARKS:

This application was amended in response to the Written Opinion issued by the USPTO as IPEA on 13 August 2004. Of the pending claims 1-29, claims 1, 2, 8, and 11 were found to lack novelty, claims 1-15, 17, 19, and 24-29 were found to lack inventive step, and claims 16, 18, and 20-23 were deemed to be patentable as they were found to meet the criteria set out in PCT Article 33(2)-(4). Man et. al. was the primary reference used to allege lack of novelty and inventive-step.

The JPEG2000 standard includes mechanisms that reduce catastrophic errors due to error propagation. Since each codeblock is encoded independently, errors do not propagate between codeblocks. The standard does not specify how data within a codeblock are handled when an error is encountered. However, all known implementations of the JPEG2000 standard discard all the remaining portions of a codeblock bitstream after a propagational error is encountered.

In Man et. al., (Section 3, paragraph 1) propagational errors from variable length coding (VLC) and non-propagational errors from fixed length coding (FLC) are described. Quoting from Man et. al., "The problem with VLC in noisy channels is that it introduces inter-symbol dependencies within the coded bit stream. Correct decoding of each source symbol depends on the correctness of all the preceding decoded symbols. On the other hand, FLC schemes do not have this kind of problem" (p. 366, l 9-14). In other words, Man et. al. imply that when an error occurs in VLC coded data, correct decoding of any data beyond the error is impossible because of dependencies in the codestream.

The essence of Man et. al. is then a proposed modification to JPEG2000 to ensure that most data is encoded using FLC rather than VLC. In other words, Man et. al. attempt to redesign JPEG2000 to make dependencies rare in compressed codestreams. The technique proposed by Man et. al. was not adopted as part of the JPEG2000 standard. However, the effect of the JPEG2000 BYPASS switch is similar in spirit. As indicated by the Authorized Officer, Marcellin et. al. reveals that the BYPASS switch can significantly reduce the number of

symbols arithmetically (VLC) coded. Thus, Man et. al. is largely equivalent to fixing the state of the BYPASS switch to 'true' so that dependencies in the encoded data will be rare.

For this (static) switch choice, Man et. al. perform a trivial analysis of dependencies when an error is detected. If the error occurs in a non-arithmetic coded portion of the data, coding continues (and all following data are salvaged). If the error occurs in an arithmetic coded section, coding of the current codeblock halts with all following data in the codeblock discarded (and no following data are salvaged). In other words, Man et. al. force codestream dependencies to be rare. When an error occurs, their analysis of dependencies is limited to whether dependencies exist or not (i.e., whether the error is in an arithmetic coded portion or not). Salvaging of data is then either total or non-existent. Specifically, if the error occurs in a portion of the data having dependencies, salvaging is non-existent. This is supported by the following quote from Man et. al.: "In the EBCOT coding passes, any bit error is in fact a propagational error because the extensive use of arithmetic coding. Therefore one bit error may cause the loss of a whole packet and all the rest of the packets in the same subband block. However in our bit stream, only bit errors in the P1 and P3 passes may cause similar damages" (p. 366, l 33-40).

In contrast, the present invention acknowledges that dependencies exist in codestreams from JPEG2000 (and other VLC coding systems) and that such dependencies are governed by whatever coding options (switch settings) were chosen during encoding. The resulting dependencies are carefully analyzed, and a determination is made as to which data that follow the error within the partition may still be decoded. Specifically, the present invention analyzes dependencies and salvages data following an error, even when data following the error depend on said error. The present invention controverts the belief held by current practitioners, and specifically espoused by Man et. al., that "correct decoding of each source symbol depends on the correctness of all the preceding decoded symbols" (p. 366, l 11-13). The present invention carefully analyzes data after the error. Even though some such data may be rendered undecodable by said error, still other data may be salvageable.

To further clarify the differences between the present invention and Man et al.'s disclosure, claim 1 has been amended, through the addition of "in which data that follow the error

depend on said error" after the step of detecting an error in a partition set, to emphasize that data are salvaged following an error even though data following the error depend on said error. In some cases, partition sets will contain errors, and in some of those cases data following the error will depend on said error. Whereas Man et al. discards all such data, the present invention salvages at least some of the sections of encoded data following the error.

Support for these amendments is provided at pp. 14, lines 29-31, pp. 17, lines 7-12, and p. 19, line 32 through p. 20, line 4. Otherwise, claim 1 is substantially the same as originally filed except "at least one section" has been substituted for "what sections" and the word "that" has been inserted after the words "the partition set" as shown above.

Similarly, independent claims 12, 24, 26 and 28 have been amended in this fashion to add a limitation relating to data following an error depending on that error and to replace "what sections" and add the word "that" as indicated for claim 1. All other claims called into question by the Examiner are dependent on claims 1, 12, 24, 26 and 28. As all independent claims, as amended, are believed to be distinguished from the cited art, all dependent claims also are believed to be distinguished.

Nonetheless, in a second IPER issued on January 27, 2005, claim 1 again was found to lack novelty as being anticipated by Man et al. Specifically, citing Sect. 3, paragraph 1-3 and Sect. 4, paragraph 1, the Examiner found that Man et al. disclosed "detecting an error in a partition set in which data that follow that error depend on said error, analyzing the dependencies within the partition set, determining what sections [sic] of encoded data that follow the error in the partition set can be salvaged, and decoding the sections of encoded image data in the partition set."

The Applicant continues to disagree with this assessment. Again, claim 1 was amended to specify detecting an error in a partition set *in which data that follow the error depend on said error* and determining *at least one section* of encoded data that follow the error in the partition set that can be salvaged. Independent claims 12, 24, 26 and 28 were similarly amended. In the second IPER, the Examiner did not consider the limitation that "at least one section" is salvaged but relied on the original language of determining "what sections" could

be salvaged. Applicant respectfully believes this was an oversight and provide the following to further clarify the novelty and non-obviousness of the present invention.

We begin with a summary of the teachings of Man et al. using Figure 1 (appended hereto) that we have constructed to illustrate these teachings. In this figure, a codestream for a partition set is shown for two different cases (100, 200). Following Man et al., different portions of data are labeled P1, P2, P3, where propagational portions are labeled P1 and P3, and non-propagational portions are labeled P2. In non-propagational portions, data that follow an error do not depend on the error. In propagational portions, data that follow an error do depend on the error. Shaded areas in the figure represent portions of data which are not decodable, according to Man et al..

When an error occurs in a non-propagational portion P2, all data after the error are still decodable (Man et al, Section 3, paragraph 2, lines 15-18). Thus, there is no shading in the codestream marked 100. When an error occurs in a propagational portion, e.g., P1, the situation is different. According to Man et al. (Section 3, paragraph 2, lines 11-15), all data following such an error are not decodable. Thus, if Man et al. detects an error in a partition set in which data that follow the error depend on said error, no sections of data are salvaged. This is indicated by the shading in the codestream marked 200.

Clearly then, Man et al. do not teach the invention described in claim 1, as amended. With respect to this claim, there is a critical omission in Man et al. In particular, when Man et al. performs the step of "detecting an error in a partition set in which data that follow the error depend on said error," they then conclude (their belief) that all data that follow the error (within the partition set) is useless and discard the data. They do not perform applicant's claimed steps of "determining at least one section of encoded data that follow the error in the partition set that can be salvaged, and decoding said sections of encoded image data in the partition set." In fact, Man et al.'s belief that all data following an error in a propagational partition set are useless specifically teaches away from taking steps to salvage any of that data.

In contrast, the unshaded portions (following the error) of the codestream marked 300 in Figure 2 (appended hereto) below indicate portions of the codestream that are decodable via the claimed invention. Specifically, portions of the data following the error are decodable by the method of the present invention, even though the error occurs in a propagational portion of the codestream. Support for the behavior of the claimed invention as described above can be found in Figures 15-18 (and others), together with their associated text in the PCT application. As described under "Experimental Results" at p. 24 of the application, salvaging at least one section of data that follows an error in a propagation stream can increase the gain in simulations by as large as 8.6 dB and greater than 2.7 dB in roughly 20% of the cases.

In view of the above, the applicants respectfully submit that the claims define patentable subject matter. No fee is believed to be due with this amendment. Should there be any unforeseen costs, please charge our Deposit Account No. 17-0055.

Respectfully submitted,

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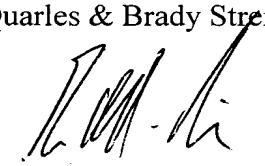

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